

V.3.3-API-CIN CINCINNATI (OHRFC) API-RUNOFF OPERATION

Identifier: API-CIN

Application: All Programs

Description: This Operation calculates Antecedent Precipitation Indices (API) and runoff amounts for given runoff zones.

API values are daily and runoff amounts are 6 hourly. Input data are zonal rainfall/melt, synthetic temperature and snow water-equivalent amounts. A technical description of the Cincinnati API-Runoff Procedure is given in Chapter II.3 of the User's Manual.

Special provisions of this Operation include:

1. The minimum period for which the Operation can be executed is 1 day. Operationally the day ends at 12Z.
2. The data time interval for rainfall/melt, temperature and runoff is fixed at 6 hours.
3. Input values of water-equivalent are daily values.
4. Initial carryover values may be specified by the user when the Operation is initialized for a runoff zone. These values include the storm period counter, storm total rainfall/melt, storm AI, storm total runoff, current API, current AI, current water-equivalent, current average air temperature, current uncorrected synthetic temperature and the current synthetic temperature(corrected). If default carryover values are used, the storm period counter is initially set to 4, the current average temperature to 50.0, the current uncorrected and corrected synthetic temperature to 51.0 and the rest of the values to 0.
5. The 24 hour rainfall/melt is stored with the carryover for display purposes. This value is always set to zero when a runoff zone is initialized.
6. The option is available to allow the user to request output time series containing current API and/or adjusted storm AI values.

Developed by: Ohio River Forecast Center

Allowable Data Time Interval: 6 hours

Time Series Used: Time series used in this Operation are as follows:

General Type	Dimn	Units	Use	Required	Form of Output T.S.	Data Time Interval	Missing Values Allowed
Rainfall/melt	L	MM	I	yes	n/a	6 hrs	no
Water equivalent	L	MM	I	yes	n/a	24 hrs	no
Temperature	TEMP	DEGC	I	yes	n/a	6 hrs	no
Runoff	L	MM	O	yes	Replaces	6 hrs	no
API	L	MM	O	no	Replaces	24 hrs	no
AI	DLES	R	O	no	Replaces	24 hrs	no

Input Card Summary: Input cards required for the Operation are as follows:

Card	Format	Columns	Contents
1	6A4	1-24	Runoff zone name
	I6	25-30	Runoff zone number (not used by the Operation - for external use only)
	I5	31-35	Alternate zone number (not used by the Operation - for external use only)
	I5	36-40	Latitude in degrees and minutes of the centroid of the runoff zone; range is 3515 through 4230
	I5	41-45	Longitude in degrees and minutes of the centroid of the runoff zone; range is 7745 through 8930
	F5.1	46-50	AI adjustment factor (in tenths); range is -4.0 through 4.0; default value is 0.0
	F5.1	51-55	Synthetic temperature adjustment factor (units of tenths degree DEGF); range is -30.0 through 30.0; default value is 0.0
	F5.2	56-60	Precipitation recession factor (hundredths) applied to 24 hour precipitation at end of hydrologic day; range is 0.50 through 1.00; default value is 0.90
	F5.2	61-65	API recession factor (in hundredths) applied to today's beginning API; range is 0.50 through 1.00; default value is

<u>Card</u>	<u>Format</u>	<u>Columns</u>	<u>Contents</u>
			0.90
2	F5.2	1-5	API recession factor with snow (in hundredths) applied to today's beginning API; range is 0.50 through 1.00; default value is 0.90
	F5.2	6-10	Water-equivalent (units of hundredths of an IN) above which API recession factor with snow is used; range is 0.00 through 12.00; default is zero
	I5	11-15	Output API and/or adjusted storm AI time series indicator; if blank (zero), API and AI time series are not generated; a positive value triggers reading of Card 4 with the time series identification
	I5	16-20	Input carryover indicator; if blank (zero) no initial carryover values are read; any positive value will read Card 5 with actual carryover values
3	I5	1-5	Data time interval of rainfall/melt, temperature and runoff time series (units of HR); current version requires a data time interval of 6 hours; default value is 6 hours
	2X,2A4	8-15	Internal identifier of rainfall/melt time series
	1X,A4	17-20	Data type code of rainfall/melt time series
	2X,2A4	23-30	Internal identifier of runoff time series
	1X,A4	32-35	Data type code of runoff time series
	2X,2A4	38-45	Internal identifier of water-equivalent time series
	1X,A4	47-50	Data type code of water-equivalent time series
	2X,2A4	53-60	Internal identifier of temperature time series
	1X,A4	62-65	Data type code of temperature time series

Card 4 is optional and required only if API and/or AI time series are to be generated. The output API and/or AI time series

Card	Format	Columns	Contents
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indicator (columns 11-15 of Card 2) must contain any positive value if Card 4 is to be read.

4	7X,2A4	8-15	Internal identifier of API time series; blank if no time series desired.
	1X,A4	17-20	Data type code of API time series; blank if no time series desired
	2X,2A4	23-30	Internal identifier of adjusted storm AI time series; blank if no time series desired
	1X,A4	32-35	Data type code of AI time series; blank if no time series desired.

Card 5 is optional and required only if actual carryover values are to be input. The input carryover indicator (columns 16-20 of Card 2) must contain any positive value if Card 5 is to be read. If any values are entered, all must be entered.

5	I5	1-5	Storm period counter; range 0 - 4
	F5.2	6-10	Storm total rainfall/melt (units of IN); range 0.00 - 50.00
	F5.1	11-15	Adjusted storm AI; range 1.2 - 7.6
	F5.2	16-20	Storm total runoff (units of IN); range 0.00 - 50.00
	F5.2	21-25	API value at the end of the previous day (units of IN); range -4.00 - 4.00
	F5.1	26-30	Adjusted AI at the end of the previous day; range 1.2 - 7.6
	F5.2	31-35	Water equivalent for the previous day (units of IN); range 0.00 - 20.00
	F5.1	36-40	Average air temperature for the previous day (units of DEGF); range -20.0 - 105.0
	F5.1	41-45	Antecedent temperature (uncorrected synthetic temperature) at the end of the previous day (units of DEGF); range 15.0 - 100.0
	F5.1	46-50	Corrected synthetic temperature at the end of the previous day (units of DEGF); range 15.0 - 100.0

Sample Input and Output: Sample input is shown in Figure 1. Sample

output from the parameter print routine is shown in Figure 2. There is no execution routine output.

Error Messages: The error messages generated during the setup step for this Operation and the corrective measures to take are as follows:

1. ****ERROR**** ILLEGAL RUNOFF ZONE NUMBER: XXXX
LIMITS ARE... 101 THROUGH 4092

Action: Correct the zone number and change Card 1.

2. ****ERROR**** ILLEGAL INITIAL AI ADJ FACTOR: X.X
LIMITS ARE... -4.0 THROUGH +4.0

Action: Select correct AI adjustment factor and change Card 1.

3. ****ERROR**** ILLEGAL TIME STEP (DELTA-T): XX
VALUE MUST BE 6 HOURS. IF LEFT BLANK OR ZERO,
DEFAULT IS 6 HOURS.

Action: Either punch a value of 6 hours or leave field blank on Card 2.

4. ****ERROR**** ILLEGAL LATITUDE: XXXX
LATITUDE MUST BE BETWEEN 3515 AND 4230 (DEG MIN)

Action: Correct the latitude (deg min) and change Card 1.

5. ****ERROR**** ILLEGAL LONGITUDE: XXXX
LONGITUDE MUST BE BETWEEN 7745 AND 8930 (DEG MIN)

Action: Correct the longitude (deg min) and change Card 1.

6. ****ERROR**** ILLEGAL PRECIP RECESSON FACTOR: X.XX
LIMITS ARE... 0.50 THROUGH 1.00
DEFAULT IS 0.90

Action: Select correct precipitation recession factor and change Card 1.

7. ****ERROR**** ILLEGAL API RECESSON FACTOR: X.XX
LIMITS ARE... 0.50 THROUGH 1.00
DEFAULT IS 0.90

Action: Select correct API recession factor and change Card 1.

8. ****ERROR**** ILLEGAL API RECESSON FACTOR (SNOW): X.XX
LIMITS ARE... 0.50 THROUGH 1.00

Action: Select correct API recession factor for snow and change Card 2.

9. ****ERROR**** ILLEGAL CRITERIA WE TO USE API RECESSON FACTOR WITH
SNOW PACK: XX.XX

LIMITS ARE... 0.00 THROUGH 12.00

Action: Select correct criteria WE and change Card 2.

10. ****ERROR**** ILLEGAL INITIAL CARRYOVER VALUE.
ONE OF THE FOLLOWING VALUES IS OUTSIDE LIMITS:

<u>C/O ITEM</u>	<u>LIMITS</u>	<u>VALUE PUNCHED</u>
NEWSTM	0 - 4	XX
RANCO	0 - 50.00	XX.XX
AICO	1.2 - 7.6	X.X
ROCO	0 - 50.00	XX.XX
API	-4.00 - 4.00	XX.XX
AI	1.2 - 7.6	X.X
WE	0 - 20.00	XX.XX
AVGT	-20.0 - 105.0	XXX.X
AT	15.0 - 100.0	XXX.X
TC	15.0 - 100.0	XXX.X

Action: Determine which of the carryover values is incorrect and change Card 5. If the input carryover indicator (columns 16-20 of Card 2) is blank (zero), no Card 5 should be punched.

Carryover Transfer Rules: During the carryover transfer process for this Operation, the following rules are applicable:

1. No checks for the validity of the parametric or carryover data are made during the transfer process.
2. No alteration of the carryover data is required during the transfer process.

Punched Card Rules: When punching input cards for this Operation, the following rules are applicable:

1. The format of punched cards is identical to those described in the Input Card Summary of this documentation.
2. No checks for the validity of the parametric or carryover data are made during the punching process.
3. The data time interval of the rainfall/melt and runoff time series used by this Operation will always be punched as a value of '6'. This is true even if the value was defaulted during the original setup.
4. Carryover values may be defaulted if desired and Card 5 for each runoff zone will not be punched. The input carryover indicator (columns 16-20) of Card 2 will correspondingly be punched with a zero value.

Figure 1. Sample card input for Operation CHANLOSS

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          - Column -
    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
API-CIN      FTWNE
FORT WAYNE PAVERTIN      3105      0 4124 8506 -0.1  -5. 0.90 0.90
0.9010.00      0      0
      6 FTWNE      RAIM FTWNE      INFW FTWNE      SWE FTWNE      MAT
  
```

Figure 2. Sample output from Operation CHANLOSS print parameter routine

```

*****
API-CIN  OPERATION      NAME=FTWNE      PREVIOUS NAME=
*****

      ZONE NAME:  FORT WAYNE PAVERTIN      ZONE NUMBER:  3105      ALT ZONE NUMBER:  0
      LATITUDE:  4124      LONGITUDE:  8506
      AI ADJ FACTOR:  -0.1      TC ADJ FACTOR:  -5.0
      PRECIP REC FAC:  0.90      AP REC FAC:  0.90
      AP SNOW REC FAC:  0.90      WE REC CRITERIA:10.00
      OUTPUT TS FLAG:  0      C/O INPUT FLAG:  0

      TIME SERIES USED BY THIS OPERATION...
      CONTENTS      TS I.D.      TYPE      TIME INTERVAL
      -----      -
      RAINFALL/MELT  FTWNE      RAIM      6 HOURS
      RUNOFF          FTWNE      INFW      6 HOURS
      WATER EQUIVALENT  FTWNE      SWE      24 HOURS
      TEMPERATURE     FTWNE      MAT      6 HOURS

      CARRYOVER VALUES...

      DEFAULT VALUES WERE USED.
  
```